

**NOAA EXPERIMENTAL DIVING UNIT
REPORT 82-01**

**POTENTIAL APPLICATIONS of
VORTEX TUBE TECHNOLOGY in the COOLING,
DEHUMIDIFICATION and
HEATING of HYPERBARIC ENVIRONMENTS**

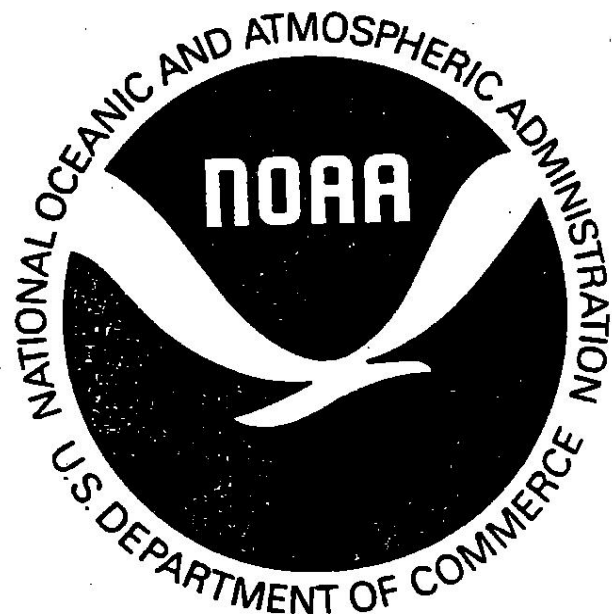
By

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Camp Springs, MD**



DIVING PROGRAM

NOAA EXPERIMENTAL DIVING UNIT
Report 92-1

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of
VORTEX TUBE TECHNOLOGY in the COOLING, DEHUMIDIFICATION
and
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Vortex tubes are small devices with no moving parts, capable of producing streams of cold and hot air from a single low pressure compressed air source. They are commonly used for cooling electronic component cabinets and small metal parts during machining.

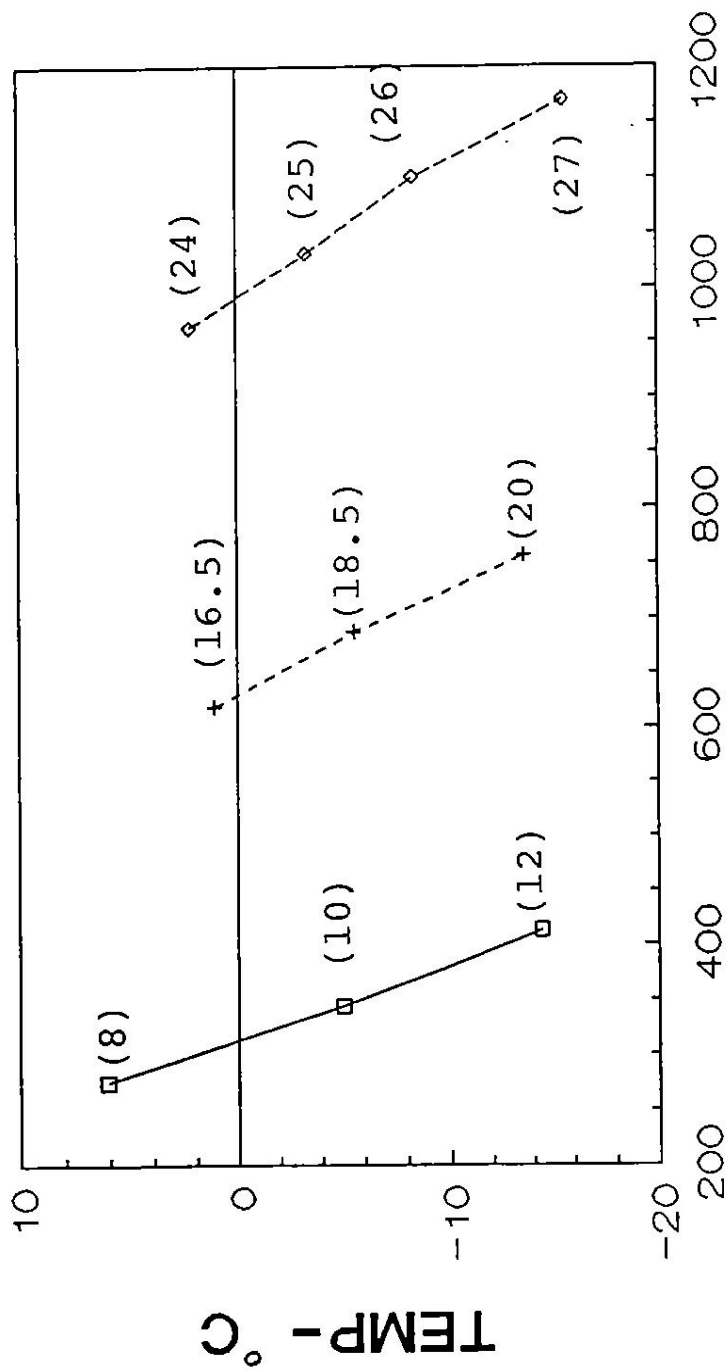
No information was available from manufacturers on their function under hyperbaric conditions. Since these devices seemed to have important potential applications in the hyperbaric field, tests were conducted at the NOAA Experimental Diving Unit to determine their effectiveness at increased gas pressure and density. Sample data from these tests (below) shows that the vortex tubes functioned well under hyperbaric conditions.

DEPTH (fsw)	SUPPLY AIR FLOW (scfm)	SUPPLY AIR PRESSURE (psi)	COLD AIR TEMP. (°F)
5	12	60	6
33	20	110	7.5
66	27	170	4

The air flow rates selected were within the range normally used for chamber ventilation, and thus represents a "free" source of energy. Both the cold and hot air fractions are of potential use in hyperbaric environmental control, diving, and support systems and activities. Further testing is currently being conducted under field conditions.

* Presented at the 1992 Undersea and Hyperbaric Medical Society Annual Scientific Meeting Engineering Program.

VORTEX TUBE EXPERIMENT



VORTEX SUPPLY PRESSURE - kPa

□ 5 FSW + 33 FSW ◇ 66 FSW
 SUPPLY AIR FLOW (scfm)

NOAA EXPERIMENTAL DIVING UNIT CONVERSION TABLE

Temperature

$$^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32$$

$$^{\circ}\text{R} = ^{\circ}\text{F} + 459.67$$

$$^{\circ}\text{C} = 5/9 \times (^{\circ}\text{F} - 32)$$

$$\text{K} = ^{\circ}\text{C} + 273.15$$

Pressure (Depth)

1 Atmosphere	=	33 Feet Sea Water
1 Atmosphere	=	10.1 Meters Sea Water
1 Atmosphere	=	14.7 Pounds/Square Inch
1 Atmosphere	=	101.325 kPa
1 Foot Sea Water	=	0.030 Atmospheres
1 Foot Sea Water	=	0.3048 Meters Sea Water
1 Foot Sea Water	=	0.445 Pound/Square Inch
1 Foot Sea Water	=	3.063 kPa
1 Meter Sea Water	=	0.099 Atmospheres
1 Meter Sea Water	=	3.28 Feet Sea Water
1 Meter Sea Water	=	1.45 Pound/Square Inch
1 Meter Sea Water	=	10.0 kPa
1 Pound/Square Inch	=	0.068 Atmospheres
1 Pound/Square Inch	=	2.25 Feet Sea Water
1 Pound/Square Inch	=	0.68 Meters Sea Water
1 Pound/Square Inch	=	6.8965 kPa
1 kPa	=	0.009869 Atmospheres
1 kPa	=	0.326 Feet Sea Water
1 kPa	=	0.1 Meters Sea Water
1 kPa	=	0.145 Pound/Square Inch

Volume

1 Cubic Foot	=	28.32 Liters
1 Cubic Foot	=	0.028 Cubic Meters
1 Cubic Foot	=	7.48 Gallons
1 Liter	=	0.035 Cubic Feet
1 Liter	=	0.001 Cubic Meters
1 Liter	=	0.264 Gallons
1 Cubic Meter	=	35.31 Cubic Feet
1 Cubic Meter	=	1000 Liters
1 Cubic Meter	=	264.2 Gallons
1 Gallon	=	0.13 Cubic Feet
1 Gallon	=	3.79 Liters
1 Gallon	=	0.0038 Cubic Meters

NOAA EXPERIMENTAL DIVING UNIT
METRIC PREFIXES

<u>Prefix</u>	<u>Symbols</u>	<u>Number</u>
Peta-	P	$\times 10^{15}$
Tera-	T	$\times 10^{12}$
Giga-	G	$\times 10^9$
Mega-	M	$\times 10^6$
Kilo-	k	$\times 10^3$
Hecto-	h	$\times 10^2$
Deka-	da	$\times 10^1$
Deci-	d	$\times 10^{-1}$
Centi-	c	$\times 10^{-2}$
Milli-	m	$\times 10^{-3}$
Micro-	μ	$\times 10^{-6}$
Nano-	n	$\times 10^{-9}$
Pico-	p	$\times 10^{-12}$
Femto-	f	$\times 10^{-15}$